Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE

Tuesday 20 May 2025

Afternoon (Time: 2 hours) | **Paper reference** **4PM1/01**

Further Pure Mathematics

PAPER 1

Calculators may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **NOT** write anything on the formulae page.
  Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ▶

Pearson

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration
Surface area of sphere $= 4\pi r^2$ **Curved surface area of cone** $= \pi r \times$ slant height **Volume of sphere** $= \frac{4}{3}\pi r^3$
Series
Arithmetic series Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$ **Geometric series** Sum to n terms, $S_n = \frac{a(1-r^n)}{(1-r)}$ Sum to infinity, $S_\infty = \frac{a}{1-r} \quad \lvert r \rvert < 1$ **Binomial series** $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \ldots + \frac{n(n-1)\ldots(n-r+1)}{r!}x^r + \ldots$ for $\lvert x \rvert < 1, n \in \mathbb{Q}$
Calculus
Quotient rule (differentiation) $\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{\mathrm{f}(x)}{\mathrm{g}(x)}\right) = \frac{\mathrm{f}'(x)\mathrm{g}(x) - \mathrm{f}(x)\mathrm{g}'(x)}{[\mathrm{g}(x)]^2}$
Trigonometry
Cosine rule In triangle ABC: $a^2 = b^2 + c^2 - 2bc\cos A$ $\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\sin(A+B) = \sin A\cos B + \cos A\sin B$ $\quad$ $\sin(A-B) = \sin A\cos B - \cos A\sin B$ $\cos(A+B) = \cos A\cos B - \sin A\sin B$ $\quad$ $\cos(A-B) = \cos A\cos B + \sin A\sin B$ $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$ $\quad$ $\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A\tan B}$
Logarithms
$\log_a x = \frac{\log_b x}{\log_b a}$

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There are no questions on this page.

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 A particle P moves in a straight line. At time t seconds, the velocity, v m/s, of P is given by

$$v = 3t^2 - 9t + 7$$

(a) Show that P never comes to rest. **(2)**

(b) Find the acceleration of P, in m/s^2, when $t = 4$ **(2)**

Using algebra

(c) find the distance, in m, that P travels in the interval $0 \leqslant t \leqslant 5$ **(3)**

(a) $0 = 3t^2 - 9t + 7$

If $b^2 - 4ac < 0$ Then P never Comes to rest

$(-9)^2 - 4(3)(7)$

-3

$-3 < 0$ ∴ P never comes to rest

(b) $a = \frac{dv}{dt} = 6t - 9$

At $t=4$, $a = 6(4) - 9$

$a = 15 \text{ m/s}^2$

(c) $d = \int_0^5 3t^2 - 9t + 7 \, dt$

$d = \left[\frac{3t^3}{3} - \frac{9t^2}{2} + 7t\right]_0^5$

$d = \left[t^3 - \frac{9}{2}t^2 + 7t\right]_0^5$

$d = \left[(5)^3 - \frac{9}{2}(5)^2 + 7(5)\right] - \left[(0)^3 - \frac{9}{2}(0)^2 + 7(0)\right]$

$d = \frac{95}{2}$ m

P 7 2 8 6 5 A 0 4 3 6

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Question 1 continued

(Total for Question 1 is 7 marks)

Turn over

2 The point A has coordinates $(3,2)$, the point B has coordinates $(8,3)$ and the point C has coordinates $(4,7)$

(a) Show that ABC is an isosceles triangle.

(2)

The midpoint of BC is M

(b) Find an equation of the line that passes through A and M

Give your answer in the form $y = mx + c$

(3)

The points A, C and D are collinear such that $AD = kAC \quad (k > 1)$

Given that $\angle ABD = 90°$

(c) find the coordinates of D
Show your working clearly.

(8)

(a) $AB = \sqrt{(8-3)^2 + (3-2)^2} = \sqrt{26}$ $\qquad D = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$BC = \sqrt{(8-4)^2 + (3-7)^2} = 4\sqrt{2}$

$AC = \sqrt{(4-3)^2 + (7-2)^2} = \sqrt{26}$

$AB = AC = \sqrt{26}$, ΔABC is an isosceles triangle.

(b) $M\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ $\quad B(8,3)$ (x_2, y_2) $\quad C(4,7)$ (x_1, y_1)

$M\left(\frac{8+4}{2}, \frac{3+7}{2}\right)$, $\quad M(6,5)$ (x_2, y_2) $\quad A(3,2)$ (x_1, y_1)

gradient, $m_{AM} = \frac{y_2-y_1}{x_2-x_1}$

$m_{AM} = \frac{5-2}{6-3} = \frac{3}{3} = 1$

$y - y_1 = m(x - x_1)$

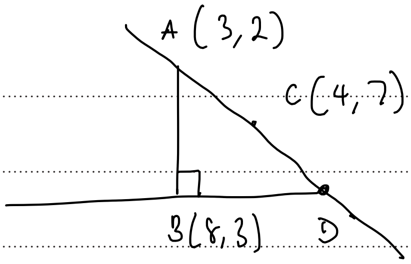
$y - 2 = 1(x - 3)$

$y = x - 3 + 2$

$y = x - 1$ Equation of Line AM

Question 2 continued

(c)



$m_{AB} = \frac{3-2}{8-3} = \frac{1}{5}$

$m_{BD} = -5$

Equation of line BD : $y - 3 = -5(x - 8)$

$y = -5x + 40 + 3$

$y = -5x + 43$

$m_{AC} = m_{AD} = \frac{7-2}{4-3} = 5$

Equation of line AD = $y - 7 = 5(x - 4)$

$y = 5x - 20 + 7$

$y = 5x - 13$

$-5x + 43 = 5x - 13$

$+5x \qquad +5x$

$43 = 10x - 13$

$+13 \qquad +13$

$56 = 10x$

$\div 10 \qquad \div 10$

$5.6 = x$

$y = 5(5.6) - 13$

$y = 15$

D (5.6, 15)

Question 2 continued

Question 2 continued

(Total for Question 2 is 13 marks)

3

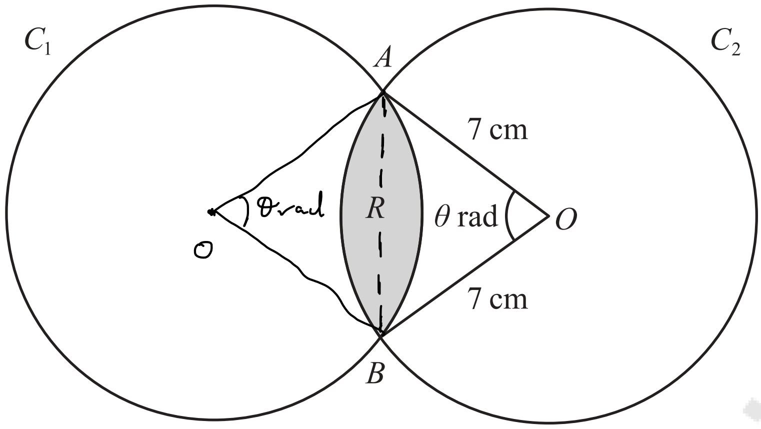


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows circle C_1 with radius 7 cm and circle C_2 with centre O and radius 7 cm

The circles C_1 and C_2 intersect at the point A and at the point B

The size of angle AOB is θ radians

The perimeter of the region R shown shaded in Figure 1 is $\frac{28\pi}{9}$ cm

(a) Find the exact value of θ

(2)

(b) Find the area, in cm² to 3 significant figures, of the region R

(4)

(a) $L = \theta r$

Left Arc AB $= 7\theta$
Right Arc AB $= 7\theta$

perimeter $= 7\theta + 7\theta = 14\theta$

$14\theta = \frac{28}{9}\pi$ (÷14 both sides)

$\theta = \frac{28}{9}\pi \times \frac{1}{14}$

$\theta = \frac{2}{9}\pi$ rad

(b) Area of Sector $= \frac{r^2\theta}{2} = 7^2 \times \frac{2}{9}\pi \times \frac{1}{2} = \frac{49}{9}\pi$ cm²

Area of triangle AOB $= \frac{1}{2}ab\sin C = \frac{1}{2} \times 7 \times 7 \times \sin\frac{2}{9}\pi = 15.748$ cm²

Half of area of region R $= \frac{49}{9}\pi - 15.748 = 1.356$ cm²

Area of region R $= 1.356 \times 2 \approx 2.71$ cm² (3 s.f.)

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Question 3 continued

(Total for Question 3 is 6 marks)

4 (a) On the grid opposite, draw the graph of the line with equation

(i) $3x + 2y = 18$ (ii) $x + 3y - 6 = 0$ (iii) $y = 3x$

(3)

(b) Show, by shading on the grid, the region R defined by the inequalities

$3x + 2y \leqslant 18$ $x + 3y - 6 \geqslant 0$ $y \leqslant 3x$

(1)

For all points in R, with coordinates (x, y)

$$P = 2x - y$$

(c) find the least value of P

(4)

a i) $3x + 2y = 18$
$2y = -3x + 18$
$y = -\frac{3}{2}x + 9$
At $y = 0$, $\frac{3}{2}x = 9$
$3x = 18$
$x = 6$
$(6, 0)$
At $x = 0$, $y = 9$
$(0, 9)$

ii) $x + 3y - 6 = 0$
$3y = -x + 6$
$y = -\frac{1}{3}x + 2$
At $y = 0$, $\frac{1}{3}x = 2$
$x = 6$
$(6, 0)$
At $x = 0$, $y = 2$
$(0, 2)$

iii) $y = 3x$
At $x = 0$, $y = 0$
At $x = 3$, $y = 9$
$(0, 0)$ $(3, 9)$

(b) $y \leq -\frac{3}{2}x + 9$ $y \geq -\frac{1}{3}x + 2$ $y \leq 3x$

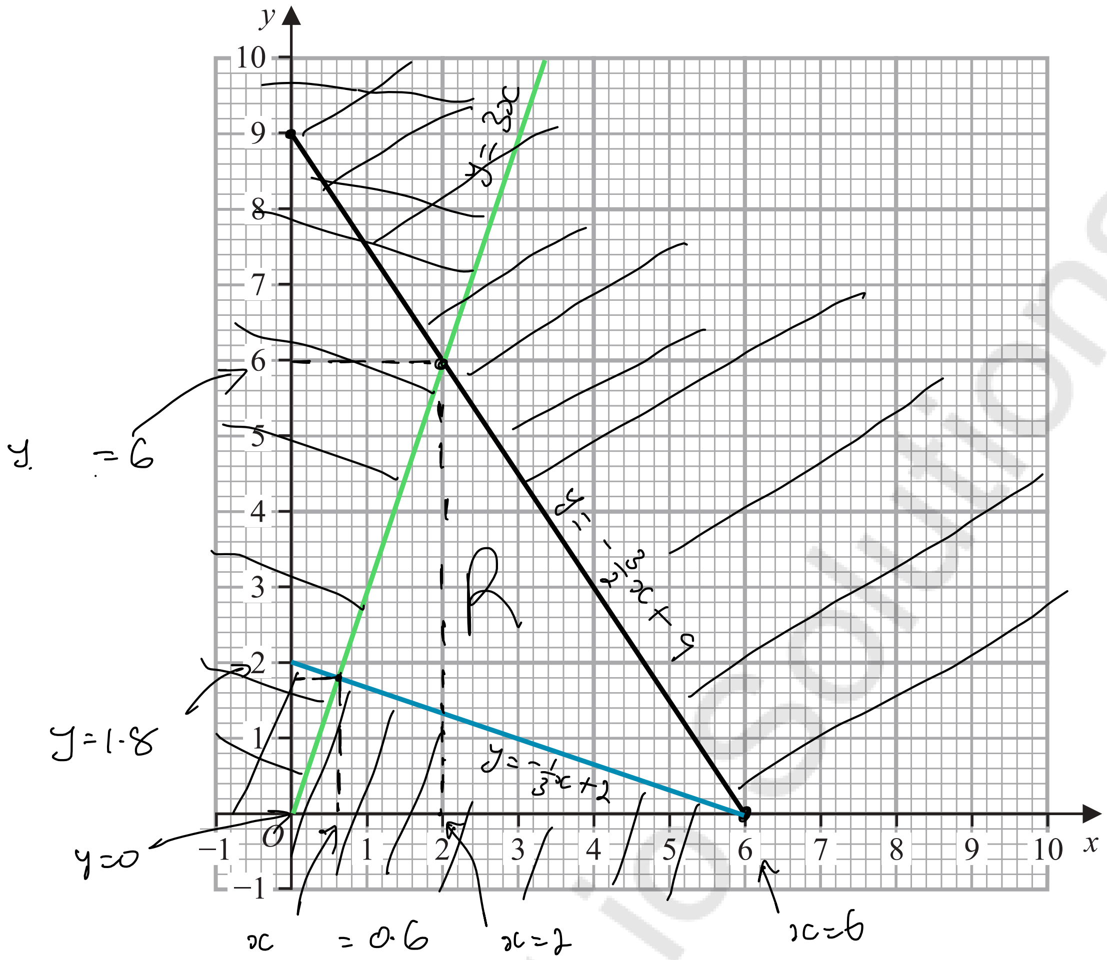
(c) $P_{min} = 2x_{min} - y_{max}$

$2(0.6) - 1.8$ $2(6) - 0$ $2(2) - 6$
$1.2 - 1.8$ $12 - 0$ $4 - 6$
-0.6 12 -2

lowest value

$P_{min} = -2$

Question 4 continued



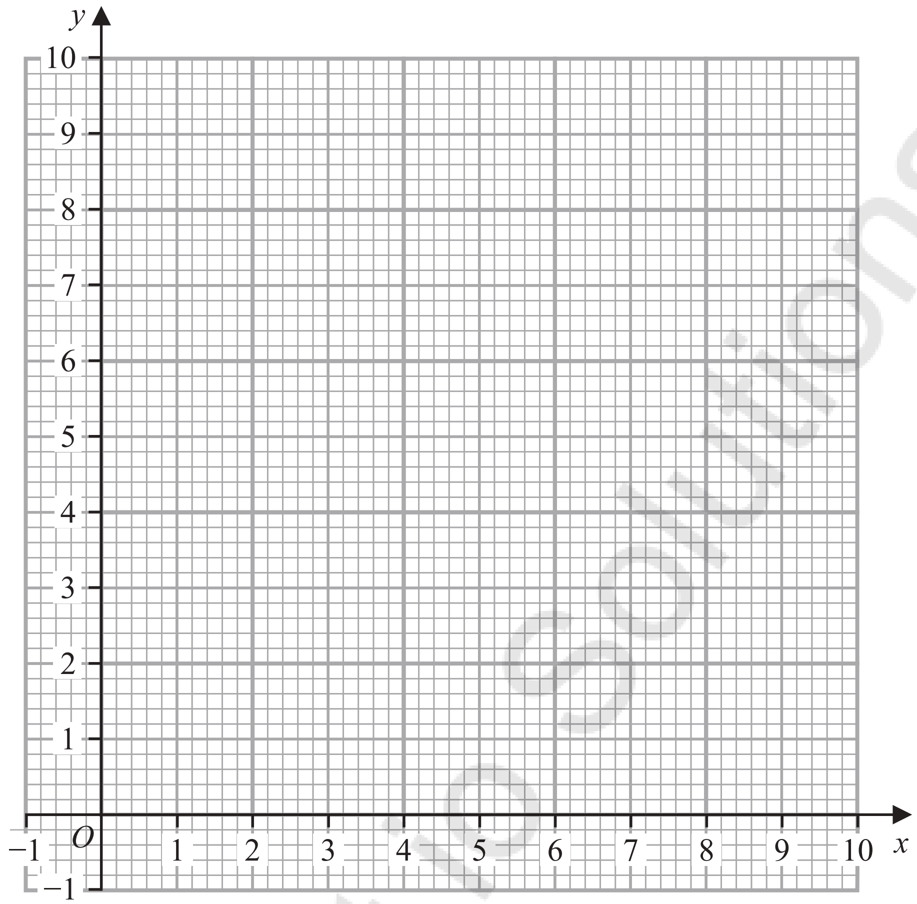
(0·6, 1·8) (6, 0) (2, 6)

Turn over for a spare grid if you need to redraw your graph.

Question 4 continued

Question 4 continued

Only use this grid if you need to redraw your graph.



(Total for Question 4 is 8 marks)

5 (a) Show that $(\alpha+\beta)^3 - 3\alpha\beta(\alpha+\beta) = \alpha^3 + \beta^3$

(2)

The quadratic equation $2x^2 - 6x - 7 = 0$ has roots α and β

Without solving the equation

(b) form a quadratic equation, with integer coefficients, which has roots $\frac{\alpha^2}{\beta}$ and $\frac{\beta^2}{\alpha}$

(6)

(a) $(\alpha+\beta)(\alpha+\beta)^2 - 3\alpha\beta(\alpha+\beta)$

$(\alpha+\beta)(\alpha^2+2\alpha\beta+\beta^2) - 3\alpha^2\beta - 3\alpha\beta^2$

$\alpha^3 + 2\alpha^2\beta + \alpha\beta^2 + \alpha^2\beta + 2\alpha\beta^2 + \beta^3 - 3\alpha^2\beta - 3\alpha\beta^2$

$\alpha^3 + 3\alpha^2\beta + 3\alpha\beta^2 - 3\alpha^2\beta - 3\alpha\beta^2 + \beta^3$

$\alpha^3 + \beta^3$ shown.

(b) $\left(x - \frac{\alpha^2}{\beta}\right)\left(x - \frac{\beta^2}{\alpha}\right)$

$x^2 - \frac{\beta^2}{\alpha}x - \frac{\alpha^2}{\beta}x + \frac{\alpha^2\beta^2}{\alpha\beta}$

$x^2 - \left(\frac{\beta^2}{\alpha} + \frac{\alpha^2}{\beta}\right)x + \frac{\alpha^2\beta^2}{\alpha\beta}$

$x^2 - \left[\frac{\beta^3}{\alpha\beta} + \frac{\alpha^3}{\alpha\beta}\right]x + \alpha\beta$

$x^2 - \left[\frac{\alpha^3+\beta^3}{\alpha\beta}\right]x + \alpha\beta$

$x^2 - \left[\frac{(\alpha+\beta)^3 - 3\alpha\beta(\alpha+\beta)}{\alpha\beta}\right]x + \alpha\beta$

$x^2 - \left[\frac{(3)^3 - 3(-\frac{7}{2})(3)}{3}\right]x + \left(-\frac{7}{2}\right)$

$x^2 - \left[-\frac{117}{7}\right]x - \frac{7}{2}$

$x^2 + \frac{117}{7}x - \frac{7}{2}$

$14x^2 + 234x - 49 = 0$

$(x-\alpha)(x-\beta)$

$x^2 - \alpha x - \beta x + \alpha\beta$

$x^2 - (\alpha+\beta)x + \alpha\beta$

$2x^2 - 6x - 7$

$2[x^2 - 3x - \frac{7}{2}]$

$\alpha+\beta = 3 \quad \alpha\beta = \frac{-7}{2}$

Question 5 continued

(Total for Question 5 is 8 marks)

6 (a) Show that $\sqrt{4-x} = A\left(1-\frac{x}{B}\right)^{\frac{1}{2}}$ where A and B are integers to be found.
(2)

(b) Hence expand $\sqrt{4-x}$ in ascending powers of x up to and including the term in x^3
Give each coefficient as an exact fraction in its lowest terms.
(3)

(c) Use your expansion with a suitable value of x to obtain an estimate of $\frac{\sqrt{305}}{10}$

Give your answer correct to 5 decimal places.
(3)

(a) $\sqrt{4\left(1-\frac{x}{4}\right)}$

$\sqrt{4}\sqrt{1-\frac{x}{4}}$

$2\sqrt{1-\frac{x}{4}}$

$2\left(1-\frac{x}{4}\right)^{1/2}$

$A=2$, $B=4$

(b) $2\left[1+\frac{1}{2}\left(-\frac{x}{4}\right)+\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{x}{4}\right)^2\left(\frac{1}{2}\right)+\left(\frac{1}{2}\right)\left(-\frac{1}{2}\right)\left(-\frac{3}{2}\right)\left(-\frac{x}{4}\right)^3\left(\frac{1}{6}\right)+\dots\right]$

$2\left[1-\frac{x}{8}-\frac{x^2}{128}-\frac{x^3}{1024}\right]$

$\sqrt{4-x} \approx 2-\frac{x}{4}-\frac{x^2}{64}-\frac{x^3}{512}+\dots$

(c) $\sqrt{4-x} = \frac{\sqrt{305}}{10}$ $\qquad \left|-\frac{x}{4}\right| < 1$

$4-x = \frac{305}{100}$ $\qquad |x| < 4$

$4-3.05 = x$ $\qquad 0.95 < 4$

$x = 0.95 = \frac{95}{100}$ $\qquad$ Thus valid value of x

$\frac{\sqrt{305}}{10} \approx 2-\frac{0.95}{4}-\frac{(0.95)^2}{64}-\frac{(0.95)^3}{512} \approx \underline{1.74672}$ (5d.p)

P 7 2 8 6 5 A 0 1 8 3 6

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Question 6 continued

(Total for Question 6 is 8 marks)

7

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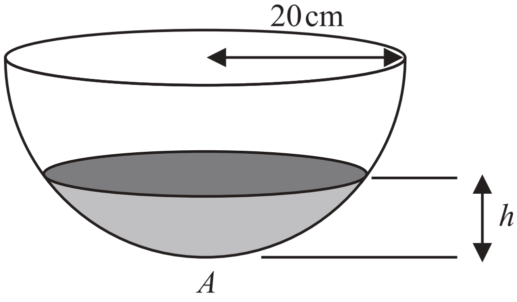

Figure 2

Figure 2 shows a hollow hemisphere with radius 20 cm

The hemisphere contains liquid, which is dripping out of a small hole at the lowest point A at a constant rate of k cm^3/s

At time t seconds after the liquid starts to drip from the hemisphere, the height of the liquid is h cm above A

The volume V cm^3 of liquid in the hemisphere is given by

$$V = \frac{\pi}{3}h^2(60 - h)$$

When $h = 12$, the height of the liquid is decreasing at a rate of $\frac{1}{60}$ cm/s

Find the value of k
Give your answer in terms of π

(6)

$\frac{dV}{dt} = \frac{dV}{dh} \times \frac{dh}{dt}$

$V = \frac{60\pi}{3}h^2 - \frac{\pi}{3}h^3$

$\frac{dV}{dh} = \frac{120}{3}\pi h - \pi h^2$

At $h = 12$, $\frac{dV}{dh} = \frac{120}{3}\pi(12) - \pi(12)^2$

$\frac{dV}{dh} = 336\pi$

At $h=12$, $\frac{dh}{dt} = \frac{1}{60}$

$\frac{dV}{dt} = 336\pi \times \frac{1}{60}$

$\frac{dV}{dt} = \frac{28}{5}\pi$ cm^3/s

$k = \frac{28}{5}\pi$

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 6 marks)

8

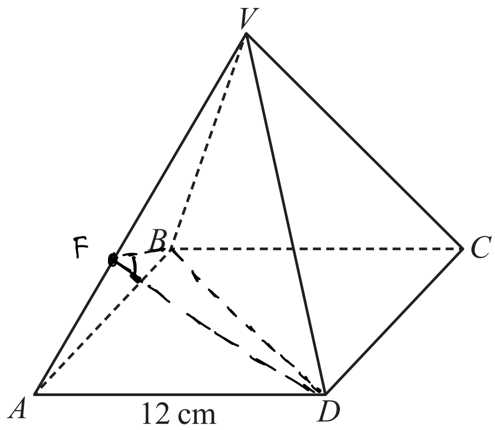

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Figure 3

Figure 3 shows a right pyramid with vertex V and square base, $ABCD$, of side 12 cm

The size of the angle between the plane VAB and the base $ABCD$ is 30°

(a) Show that the height of the pyramid is $2\sqrt{3}$ cm **(2)**

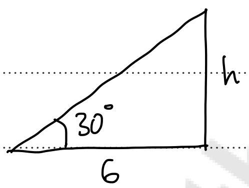
(b) Find, in cm, the exact length of VA **(3)**

(c) Find, in cm^2, the exact area of triangle VAD **(3)**

(d) Find, in cm, the exact length of the perpendicular from D to VA **(2)**

(e) Find, in degrees to one decimal place, the size of the obtuse angle between the plane VAB and the plane VAD **(3)**

(a)

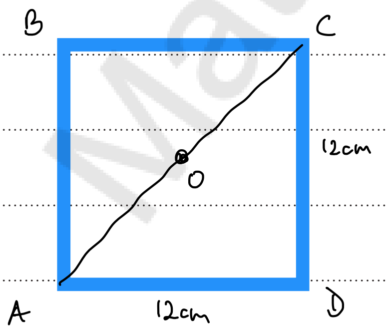


$\tan 30 = \frac{h}{6}$

$\frac{\sqrt{3}}{3} = \frac{h}{6}$

$h = \frac{6\sqrt{3}}{3} = 2\sqrt{3}$ cm

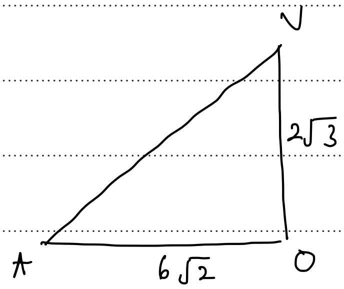
(b)



$AC^2 = 12^2 + 12^2$

$AC = \sqrt{288}$

$AO = \frac{\sqrt{288}}{2} = 6\sqrt{2}$ cm

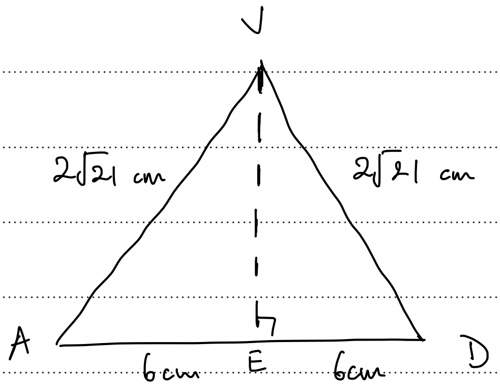


$VA^2 = (6\sqrt{2})^2 + (2\sqrt{3})^2$

$VA = \sqrt{(6\sqrt{2})^2 + (2\sqrt{3})^2} = 2\sqrt{21}$ cm

Question 8 continued

(c)



$VA = VD = 2\sqrt{21}$ cm

Square based pyramid.

$VE^2 + 6^2 = (2\sqrt{21})^2$

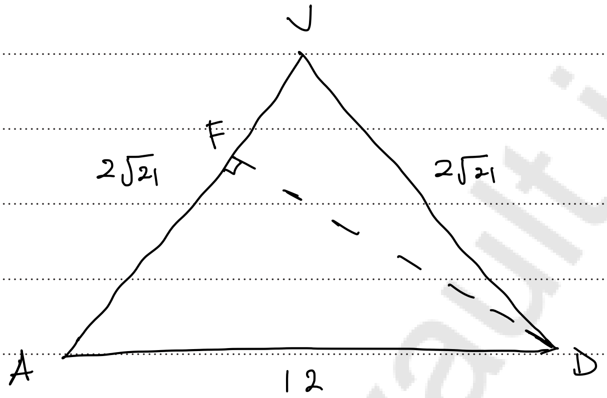
$VE^2 = (2\sqrt{21})^2 - 6^2$

$VE = \sqrt{(2\sqrt{21})^2 - 6^2}$

$VE = 4\sqrt{3}$ cm

Area of $\Delta VAD = \dfrac{12 \times 4\sqrt{3}}{2} = \underline{\underline{24\sqrt{3}\ \text{cm}^2}}$

(d)



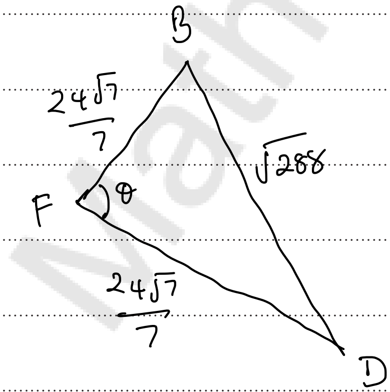
$24\sqrt{3} = \dfrac{2\sqrt{21} \times DF}{2}$

$48\sqrt{3} = 2\sqrt{21} \times DF$

$\dfrac{48\sqrt{3}}{2\sqrt{21}} = DF$

$\underline{\underline{\dfrac{24\sqrt{7}}{7}\ \text{cm} = DF}}$

(e)



$BD = AC = \sqrt{288}$

$(\sqrt{288})^2 = \left(\dfrac{24\sqrt{7}}{7}\right)^2 + \left(\dfrac{24\sqrt{7}}{7}\right)^2 - 2\left(\dfrac{24\sqrt{7}}{7}\right)\left(\dfrac{24\sqrt{7}}{7}\right)\cos B\hat{F}D$

$B\hat{F}D = \cos^{-1}\left[\dfrac{\left(\frac{24\sqrt{7}}{7}\right)^2 + \left(\frac{24\sqrt{7}}{7}\right)^2 - (\sqrt{288})^2}{2\left(\frac{24\sqrt{7}}{7}\right)\left(\frac{24\sqrt{7}}{7}\right)}\right]$

$B\hat{F}D \approx \underline{\underline{138.6^\circ}}$ (1 d.p.)

Question 8 continued

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Question 8 continued

(Total for Question 8 is 13 marks)

9

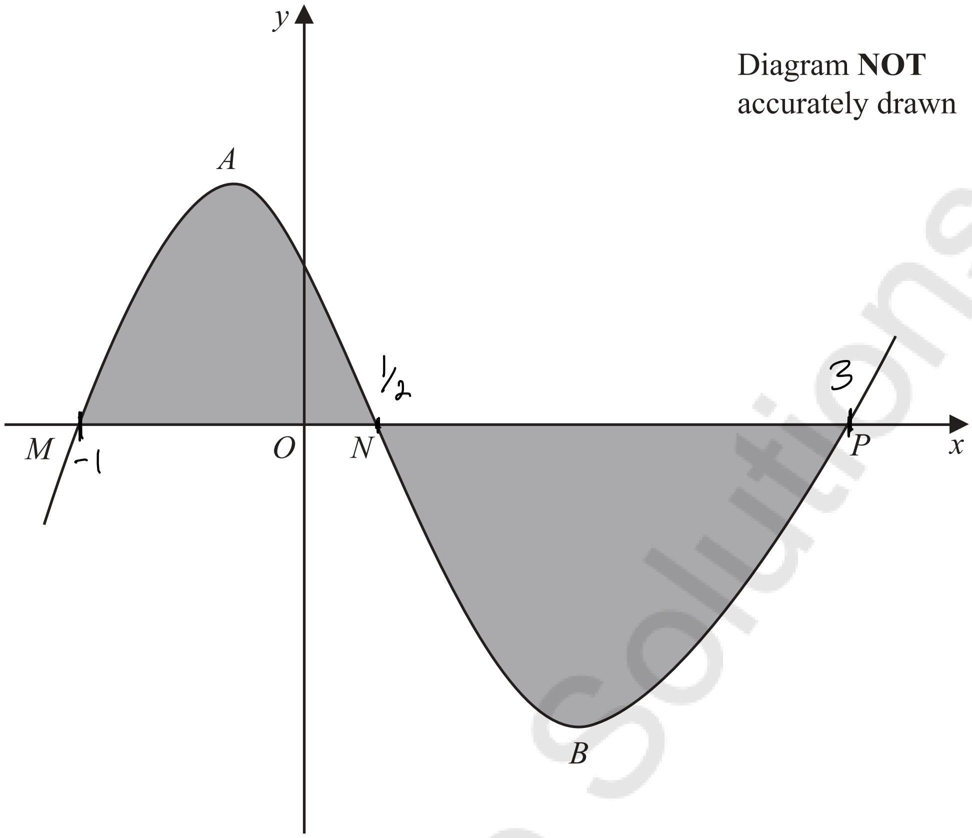

Figure 4

Figure 4 shows a sketch of part of the curve C with equation $y = f(x)$ where

$$f(x) = 2x^3 + ax^2 + bx + c$$

The curve C has a maximum at the point A with coordinates $\left(-\frac{1}{3}, \frac{100}{27}\right)$ and a minimum at the point B with coordinates $(2, -9)$

Given that a, b and c are integers

(a) show that $a = -5, b = -4$ and $c = 3$

(5)

(b) (i) Show that $(x+1)$ is a factor of $f(x)$

(1)

(ii) Hence, or otherwise, use algebra to factorise $f(x)$ completely.

(3)

The curve C crosses the x-axis at the points M, N and P
The finite regions shown shaded in Figure 4 are bounded by the curve C and parts of the x-axis from M to N and from N to P

(c) Use algebraic integration to determine the total area of the shaded regions. Give your answer as an exact fraction.

(4)

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Question 9 continued

(a) $f(x) = 2x^3 + ax^2 + bx + c$

$f'(x) = 6x^2 + 2ax + b$

$f'(2) = 0$, $6(2)^2 + 2a(2) + b = 0$

$24 + 4a + b = 0$, $b = -24 - 4a$

$f'(-\frac{1}{3}) = 0$, $6(-\frac{1}{3})^2 + 2a(-\frac{1}{3}) + b = 0$

$\frac{6}{9} - \frac{2a}{3} + b = 0$, $b = \frac{2a}{3} - \frac{2}{3}$

$-24 - 4a = \frac{2a}{3} - \frac{2}{3}$

$-24 + \frac{2}{3} = \frac{2}{3}a + 4a$

$-72 + 2 = 2a + 12a$

$-70 = 14a$

$-5 = a$

$b = -24 - 4(-5) = -24 + 20$

$b = -4$

$f(2) = -9$, $2(2)^3 + (-5)(2)^2 + (-4)(2) + c = -9$

$16 - 20 - 8 + c = -9$

$c = -9 - 16 + 20 + 8$

$c = 3$

$f(x) = 2x^3 - 5x^2 - 4x + 3$

(b) i) $f(-1) = 2(-1)^3 - 5(-1)^2 - 4(-1) + 3$

$f(-1) = -2 - 5 + 4 + 3$

$f(-1) = 0$ $\therefore$ $x + 1$ is a factor of $f(x)$

Question 9 continued

ii)

$$\begin{array}{r} 2x^2 - 7x + 3 \\ x+1 \,\big|\, 2x^3 - 5x^2 - 4x + 3 \\ -(2x^3 + 2x^2) \\ \hline -7x^2 - 4x \\ -(-7x^2 - 7x) \\ \hline 3x + 3 \\ 3x + 3 \\ \hline 0 \quad 0 \end{array}$$

$f(x) = (x+1)(2x^2 - 7x + 3)$

$f(x) = (x+1)(x-3)(2x-1)$

(c) $x = -1 \quad x = 3 \quad x = \frac{1}{2}$

$M(-1,0) \quad P(3,0) \quad N\left(\frac{1}{2},0\right)$

$$\int_{-1}^{1/2} (2x^3 - 5x^2 - 4x + 3)\,dx$$

$$\left[\frac{2x^4}{4} - \frac{5x^3}{3} - \frac{4x^2}{2} + 3x\right]_{-1}^{1/2}$$

$$\left[\frac{x^4}{2} - \frac{5}{3}x^3 - 2x^2 + 3x\right]_{-1}^{1/2}$$

$$\left[\frac{\left(\frac{1}{2}\right)^4}{2} - \frac{5}{3}\left(\frac{1}{2}\right)^3 - 2\left(\frac{1}{2}\right)^2 + 3\left(\frac{1}{2}\right)\right] - \left[\frac{(-1)^4}{2} - \frac{5}{3}(-1)^3 - 2(-1)^2 + 3(-1)\right]$$

$$\frac{117}{32}$$

$$\int_{1/2}^{3} (2x^3 - 5x^2 - 4x + 3)\,dx$$

$$\left[\frac{x^4}{2} - \frac{5}{3}x^3 - 2x^2 + 3x\right]_{1/2}^{3}$$

$$\left[\frac{(3)^4}{2} - \frac{5}{3}(3)^3 - 2(3)^2 + 3(3)\right] - \left[\frac{(1/2)^4}{2} - \frac{5}{3}(1/2)^3 - 2(1/2)^2 + 3(1/2)\right]$$

$$-\frac{1375}{96}$$

$$A = \frac{117}{32} + \left|-\frac{1375}{96}\right| = \frac{863}{48}$$

Question 9 continued

(Total for Question 9 is 13 marks)

10 Solve the equation

(i) $\log_4(6y-5)=3$

(2)

(ii) $\log_4(4-3x)^2-\log_2(x^2-5)-3=0$

Show clear algebraic working.

Give your answer to 3 significant figures.

(9)

i) $4^3 = 6y-5$

$64 = 6y-5$

$69 = 6y$

$\frac{69}{6} = y$

$\frac{23}{2} = y$

ii) $2\operatorname{Log}_4(4-3x) - \log_2(x^2-5) - 3\log_2 2 = 0$

$2\log_{2^2}(4-3x) - \log_2(x^2-5) - 3\log_2 2 = 0$

$\frac{1}{2}\times 2\log_2(4-3x) - \log_2(x^2-5) - \log_2 2^3 = 0$

$\log_2(4-3x) - \log_2(x^2-5) - \log_2 8 = 0$

$\operatorname{Log}_2\left[\frac{4-3x}{(x^2-5)(8)}\right] = 0$

$2^0 = \frac{4-3x}{8x^2-40}$

$1(8x^2-40) = 4-3x$

$8x^2+3x-40-4=0$

$8x^2+3x-44=0$

$x = \frac{-3\pm\sqrt{(3)^2-4(8)(-44)}}{2(8)}$

$x = \frac{-3+\sqrt{1417}}{16} \simeq 2.1651$ reject $x = \frac{-3-\sqrt{1417}}{16} \simeq -2.540$

Question 10 continued

(Total for Question 10 is 11 marks)

11

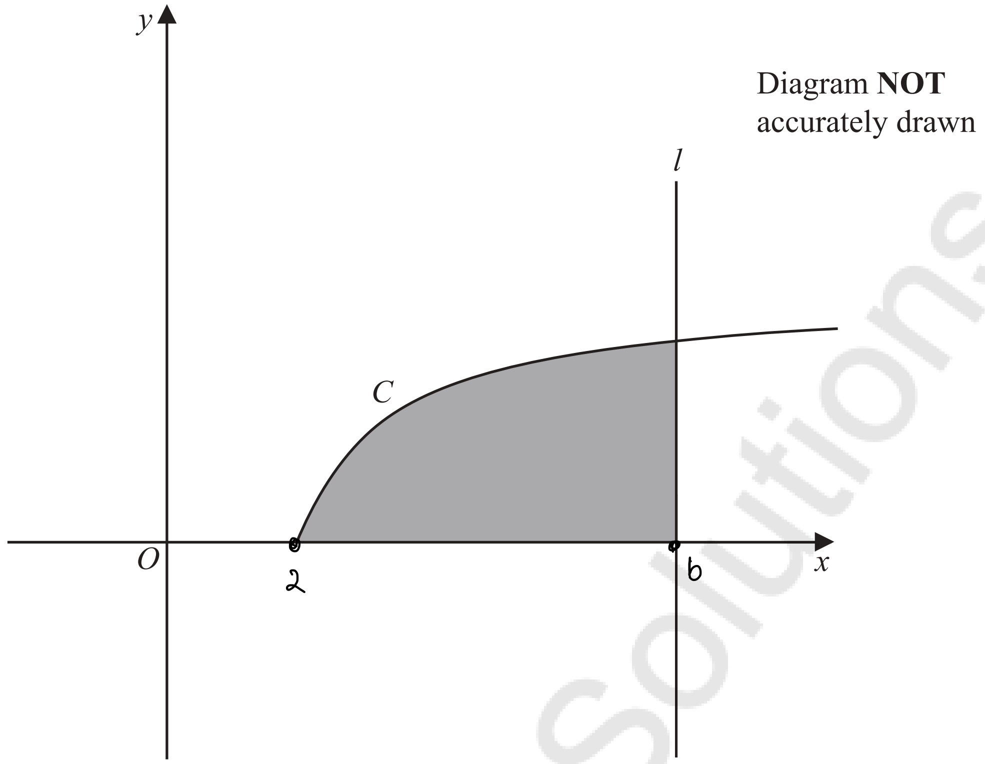

Figure 5

Figure 5 shows part of the curve C with equation $y = \sqrt{4x - 8}$ and the line l with equation $x = b$ where $b > 0$

The finite region bounded by the curve C, the x-axis and the line l, shown shaded in Figure 5, is rotated through $360°$ about the x-axis.

Given that the volume of the solid formed is 50π units^3

find the value of b

(7)

At $y=0$ $\quad 0 = \sqrt{4x-8}$

$0 = 4x - 8$

$4x = 8$, $x = 2$

$\pi \int_2^b \left[(4x-8)^{1/2}\right]^2 dx = 50\pi$

$\pi \int_2^b (4x-8)\, dx = 50\pi$

$\pi \left[2x^2 - 8x\right]_2^b = 50\pi$

$(2b^2 - 8b) - (2(2)^2 - 8(2)) = 50$

$2b^2 - 8b - 8 + 16 - 50 = 0$

$2b^2 - 8b - 42 = 0$

$b^2 - 4b - 21 = 0$

$(b+3)(b-7) = 0$

$b = -3$ reject $-3 < 2$ $\qquad$ $b = 7$ ✓ $\quad 7 > 2$

Question 11 continued

Question 11 continued

(Total for Question 11 is 7 marks)

TOTAL FOR PAPER IS 100 MARKS